Motorized Transportation, Social Status, and Adiposity The China Health and Nutrition Survey

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Motorized Transportation, Social Status, and Adiposity

The China Health and Nutrition Survey

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Background: Increased dependence on motorized transportation may contribute to obesity. Countries in rapid socioeconomic transitions, such as China, provide an opportunity to investigate such an association.

Purpose: The aim of the study was to examine the hypotheses that increased dependence on motorized transportation is related to adiposity and that this effect will be more pronounced in adults with high SES or those who live in urban regions.

Methods: Data from the longitudinal China Health and Nutrition Survey conducted from 1997 to 2006 (n=3853, aged 18–55 years at baseline, 52% women, ~7.8 years' follow-up) were used to examine the association between motorized transportation (none, 1–5 years, >5 years) and changes in body weight and waist circumference (WC) by using multivariate regression. SES factors were obtained from questionnaires. Data were analyzed in 2010.

Results: Use of motorized transportation for >5 years was related to ~1.2 kg greater weight gain (p=0.006) and ~1.0 cm larger WC gain (p=0.017) in men, when compared with the nonmotorized transportation group and adjusted for baseline age, anthropometry, dietary intake, and follow-up time. These changes were slightly more pronounced in men with higher income or from rural areas, but the difference was not significant. In women, the tendency to have motorized transportation with weight gain was less pronounced (+1.1 kg, p=0.008). Low education and high income were the most predominant factors. In 2006, motorized transportation was associated with a 1.3-fold higher OR for obesity (p_{trend}=0.054) and abdominal obesity (p_{trend}=0.047) in men, and a 2-fold higher OR of obesity in women (p_{trend} <0.001).

Conclusions: Motorized transportation was related to an increase in adiposity in the Chinese population, particularly in men.
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Introduction

With the increasing pandemic of obesity around the world, developing countries also face this health burden. In 2002, about 195 million Chinese adults were estimated to be obese (BMI ≥25).[1] The percentage of overweight in China has increased by 50% over the past decade.[2] Rapid socioeconomic, demographic, and nutritional transitions promoting unhealthy lifestyles and behavioral changes may drive the weight gain in this developing population.[3–5]

Walking or cycling as a form of "active transportation" is inversely associated with obesity and may therefore have the potential to improve public health.[6–10] In developed countries like the U.S., Canada, Sweden, and Australia, motorized transportation has been established as a dominant sedentary travel pattern for many decades. Several studies have confirmed that driving a car is associated with obesity in developed countries.[11–14]

In China, the rapid urbanization evokes equally rapid shifts toward a more sedentary lifestyle with transitions away from an agricultural economy and towards the acquisition of new technology.[15,16] For example, active transportation covered up to 80% of daily travel in China until the 1990s, but that situation declined dramatically

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thereafter.[17,18] The number of urban households possessing a private car increased about 19-fold from 1996 to 2006.[19] In 2022, China's vehicle population might reach 419 million.[20] Such a rapid increase is likely to reduce the need for "active transport" and contribute to the development of greater prevalence of obesity.

In addition, socioeconomic factors may play an important role in the development of obesity. People who have high SES or live in urbanized areas may be the first to have access to energy-dense foods, to have a decline in work-related physical activity, and to have access to motorized transportation in a developing country.[15,21] Based on the findings from the limited work done in China previously, it is hypothesized that (1) the use of motorized transportation is independently associated with changes in body weight and waist circumference; (2) this effect will be more pronounced in those with a high income or who live in urban regions; and (3) the use of motorized transportation is independently associated with the current obesity prevalence. This was studied in Chinese adults (aged 18–55 years at baseline) who participated in the longitudinal China Health and Nutrition Survey.

Methods

Participants

The China Health and Nutrition Survey (CHNS) began in 1989. It is an ongoing international collaborative project between the Carolina Population Centre at the University of North Carolina, the U.S., and the National Institute of Nutrition and Food Safety at the Chinese Centre for Disease Control and Prevention, China. The study was designed to examine the effects of health, nutrition, and family planning policies, and to see how the social and economic transformation of the Chinese society is affecting the health and nutritional status of its population. The survey took place over a 3-day period using a multistage, random-cluster process to draw a sample of about 4400 households in nine provinces that varied substantially in geography, economic development, public resources, and health indicators.[22]

Data Collection

The data of the present study were prospectively collected in the survey years 1997, 2000, 2004, and 2006. In 1997, a total of 6418 participants of those aged 18–55 years without pregnancy or physical disability were included. In total, 5240 participants completed at least one questionnaire in 2000, 2004, or 2006 (~82% follow-up, an average of 7.8 years' follow-up; Appendix A, available online at www.ajpmonline.org). Of the 5240 participants available for follow-up, 3853 completed every questionnaire during follow-up; had no missing information on occupational physical activity, SES, or anthropometric measures; and remained in the final analysis.

Assessment of Variables

Motorized transportation. The possession of motorized vehicles was defined as possessing motorcycles, tractors, or cars at the household level, assessed by using questionnaires. Participants from the same household were assumed to have equal ownership of motorized vehicles. Participants were categorized as follows: those who possessed motorized vehicles from 1997 until 2000 were defined as having used motorized transportation for 3 years, those with vehicles from 2000 to 2004 as having used motorized transportation for 4 years, and those with vehicles from 2004 to 2006 as having used motorized transportation for 2 years. Based on these time frames and registration in each survey year (1997, 2000, 2004, and 2006), the total duration of possessing motorized vehicles was calculated and categorized as nonmotorized, motorized 1–5 years, and motorized >5 years.

Physical activity. Occupational physical activity was categorized as light (e.g., sedentary job, sitting, office work); moderate (e.g., driver, electrician); or heavy (e.g., farmer, athlete, dancer, steel worker, or lumber). The total weekly energy expenditure during work was calculated by multiplying time spent and MET task scores as 2.0, 4.0, and 6.0 METs per hour, respectively, for light, moderate, and heavy occupational physical activity.[17] Gender-specified tertiles of occupational physical activity were defined. Only a limited percentage of participants attended leisure-time physical activity. Leisure-time physical activity was defined as participating or not participating in such activities.

Living region, socioeconomic status, and education. Urban or rural living region was used as a dichotomous variable to distinguish regional differences, such as economic development, infrastructure, and social environment. For SES, individual net income included the sum of all sources of income and was divided into gender-specific quantiles. Income was categorized by the median (low and high; Figure 1). Education was categorized as primary education or less, low middle school education, upper middle/technical school education, and college/university education.

Lifestyle. Smoking was defined as have never smoked, is an ex-smoker, smokes <10 cigarettes/day, and smokes ≥10 cigarettes/day. Alcohol consumption was defined as never drinking beer/any other alcoholic beverage past year, drinking less than two times/week, and more than three times/week. Because of the low prevalence of smoking and drinking among women (Appendix A, available online at www.ajpmonline.org), these two variables were not adjusted for statistical analysis in women. Dietary intake was collected by nutritionists using 24-hour recalls over 3 consecutive days with the start day randomly allocated from Monday to Sunday, and daily total energy (kcal/day) and fat (g/day) intake were calculated.

Region was assessed at the time of inclusion in the study. To obtain the best estimate of long-term habitual dietary intake, occupational physical activity, and income, the cumulative average of the variable was taken. For education, smoking, and alcohol drinking, the most recent information was assessed.

Adiposity. Obesity was defined as BMI ≥25 based on the suggested standard for the Chinese population.[23] According to the same guideline, abdominal adiposity was defined as waist circumference (WC) ≥90 cm for men and WC ≥80 cm for women. Changes in body weight and WC were calculated as the average difference of weight (WC) in kilograms (centimeters) measured at baseline and each available measure during follow-up.

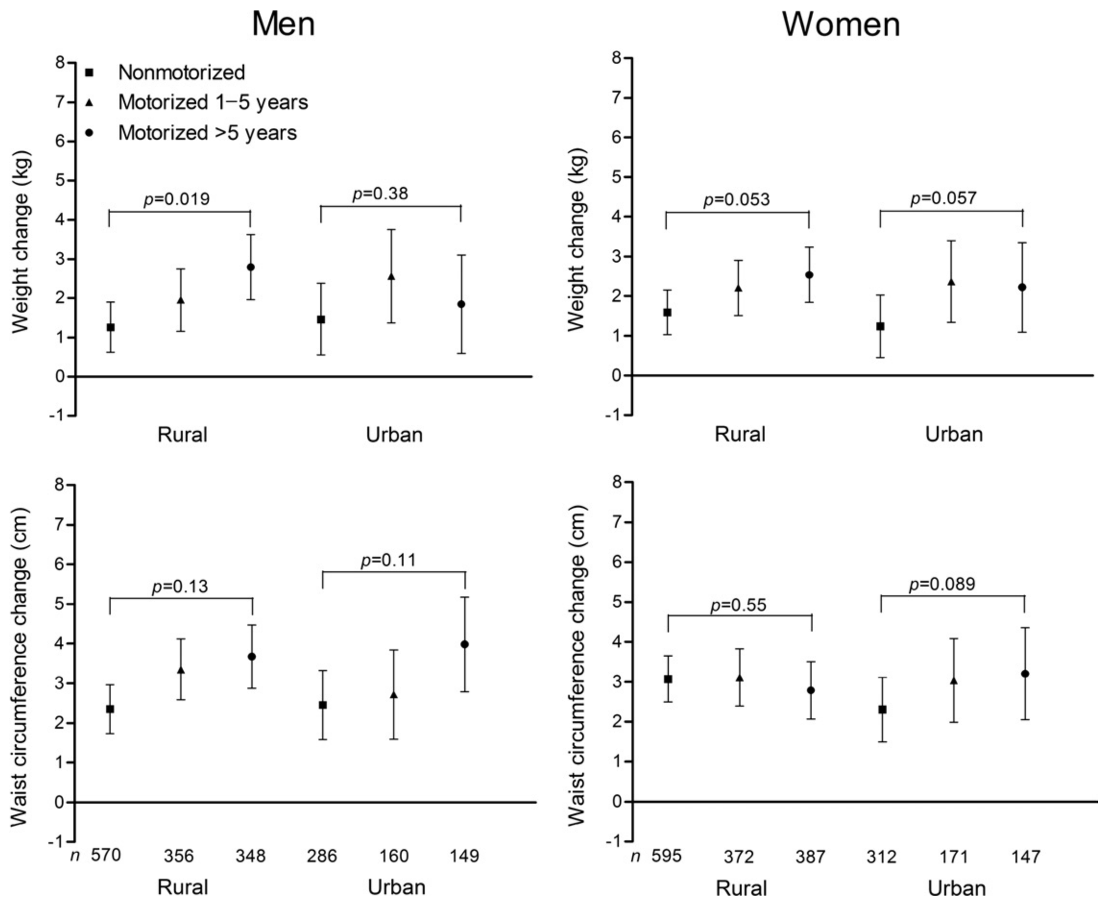

Figure 1. Changes in body weight and WCs according to duration of motorized transportation, stratified for gender and living regions

Note: Results are adjusted for baseline weight, height, age and WC (for change in WC), follow-up time, total energy and fat intake, occupational physical activity, education, and income. For men, additional adjustments were made for smoking and alcohol consumption.
WC, waist circumference

Statistical Analyses

Men and women were presented separately because of the differences in lifestyle and socioeconomic factors (Appendix A, available online at www.ajpmonline.org). Multivariate linear regression was used to assess the linear associations between motorized transportation, SES indicators, and changes in weight and WC, or current BMI and WC (as assessed by recent measures). To assess whether interaction was present, the likelihood ratio test was used to compare the significant differences of the regression models with and without the interaction term. Multivariate logistical regression was used to assess the OR for adiposity in association with motorized transportation.

Of the 5240 participants in follow-up, motorized transportation status, SES, and/or anthropometric measures were not available for 26.5% of participants. As an additional sensitivity test, the analyses were repeated by using the complete data with multiple imputations (10 imputations) for the data that were missing in these participants. The missing data were predicted based on a regression model that included baseline and end-point BMI/WC, baseline and end-point motorization, follow-up time, education, income, occupational physical activity, age, and energy and fat intake. Missing values were imputed and 10 complete data sets were analyzed separately, and the results were pooled into single estimated beta coefficients. Significance of all analyses and adjusted OR was based on two-sided 95% CI. An alpha level of 0.05 for all statistical tests was used. Statistics were performed using Stata, version 11.0.

Results

Table 1 shows the characteristics of 3853 participants. About 46% participants were not in the nonmotorized transportation category during the ~7.8 years' follow-up; 27% possessed motorized vehicles for 1–5 years, and 27% possessed vehicles for >5 years. Those who possessed motorized vehicles for >5 years had a higher WC at baseline, and showed the highest prevalence of (abdominal) obesity at the end of follow-up. Men (motorized transportation >5 years) tended to have a twofold higher weight gain than the nonmotorized transportation group (p=0.04). Motorized transportation was also related to socioeconomic factors, such as education, income (men), and rural residency (women).

Motorized transportation for >5 years was independently related to larger weight gain (2.5±0.7 kg, p=0.009)

Table 1. Characteristics of men and women according to the duration of possessing motorized vehicles, 1997–2006 (n=3853), % unless otherwise noted

Characteristics	Men: Nonmotorized transportation n (n=856)	Men: Motorized transportation 1–5 years (n=516)	Men: Motorized transportation >5 years (n=497)	Men: p^a	Women: Nonmotorized transportation (n=907)	Women: Motorized transportation 1–5 years (n=543)	Women: Motorized transportation >5 years (n=534)	Women: p^a
Participants	45.8	27.6	26.6		45.7	27.4	26.9	
Rural residence	66.6	69.0	70.0	0.38	65.6	68.5	72.5	0.02
Age (years)	46.6 (11.0)	44.8 (11.6)	45.6 (9.9)	0.05	46.7 (9.9)	46.2 (10.1)	46.9 (8.8)	0.71
Mean BMI at baseline	22.25 (3.77)	22.54 (3.77)	22.27 (2.67)	0.46	22.36 (3.96)	22.57 (3.87)	22.92 (3.65)	0.003
Mean BMI	22.90 (4.22)	23.26 (4.07)	23.43 (3.81)	0.01	22.92 (3.56)	23.70 (4.01)	23.86 (3.56)	<0.001
Mean weight change (kg)	1.3 (9.2)	1.8 (9.7)	2.9 (5.7)	0.04	1.7 (8.1)	2.2 (8.3)	2.2 (7.3)	0.63
Mean WC at baseline (cm)	77.6 (8.9)	78.2 (10.0)	78.8 (8.8)	0.002	75.2 (8.5)	75.6 (9.1)	76.0 (9.3)	0.01
Mean WC (cm)	80.6 (10.7)	81.4 (11.6)	81.9 (13.1)	0.03	78.3 (10.1)	78.9 (12.0)	79.2 (12.4)	0.14
Mean WC change (cm)	2.6 (8.2)	2.8 (9.5)	3.4 (8.1)	0.99	2.6 (7.6)	3.0 (8.6)	3.3 (8.7)	0.65
Obesity at baseline[b]	15.6	17.6	14.4	0.19	19.0	19.6	20.9	0.002
Obesity[b]	21.1	24.4	25.7	0.12	21.7	31.5	35.2	<0.001
Abdominal obesity at baseline[c]	9.7	12.1	14.3	0.04	27.2	30.4	32.7	0.08
Abdominal obesity[c]	18.2	22.3	24.7	0.01	42.3	46.8	49.8	0.02
Daily energy intake (kcal)	2572	2550	2590	0.66	2236	2224	2214	0.36
Daily fat intake (g)	76.7	74.2	77.9	0.56	68.1	69.2	69.2	0.69
Carbohydrate intake (g)	380.4	377.7	375.0	0.23	337.2	332.5	327.5	0.04
Protein (g)	73.1	74.1	76.1	0.001	63.8	64.3	65.6	0.008
Leisure-time physical activity	16.7	12.8	14.5	0.37	7.9	4.4	6.0	0.04
Occupational physical activity								
Light	40.3	30.0	29.0		38.8	28.4	32.5	
Middle	28.5	35.4	35.4		28.6	38.5	33.8	
Heavy	31.1	34.6	35.6	<0.001	32.5	33.1	33.6	<0.001
Income								
Low	27.9	26.9	18.1		26.6	27.1	20.2	
Low middle	26.0	25.8	22.3		23.8	24.9	27.5	

(continued on next page)

Table 1. *(continued)*

Characteristics	Men: Nonmotorized transportation n (n=856)	Men: Motorized transportation 1–5 years (n=516)	Men: Motorized transportation >5 years (n=497)	Men: p[a]	Women: Nonmotorized transportation (n=907)	Women: Motorized transportation 1–5 years (n=543)	Women: Motorized transportation >5 years (n=534)	Women: p[a]
Upper middle	23.8	22.1	30.0		24.4	25.0	25.8	
High	22.2	25.2	29.6	0.002	25.2	23.0	26.4	0.12
Education								
Low	34.0	28.3	26.4		51.0	53.4	51.1	
Low middle	35.3	47.3	49.7		26.5	31.7	36.3	
Upper middle	23.2	21.7	22.1		18.7	13.6	11.6	
High	7.5	2.7	1.8	<0.001	3.8	1.3	0.9	<0.001

Note: Continuous variables were presented as M (SD); categoric variables were presented as percentage.
[a]*P*-values for continuous variables were tested in linear regression mode and adjusted for baseline age and follow-up years; *p*-values for categoric variables were tested with chi-square.
[b]General obesity is BMI ≥25.
[c]Abdominal obesity is WC ≥90 cm for men and WC ≥80 cm for women.
WC, waist circumference

and WC gain (3.6±0.7 cm, p=0.016) in men, compared with the nonmotorized transportation group (1.3±0.5 kg weight and 2.6±0.5 cm WC gain), when adjusted for age, baseline anthropometry, dietary factors, and follow-up time (Table 2). Heavy occupational physical activity was associated with a smaller increase in weight (1.5±0.6 kg, p=0.048) and WC (2.0±0.6 cm, p<0.001) in men, compared with light activity (2.4±0.6 kg weight and 3.9±0.6 cm WC gain). High income and high education were associated with increased weight gain in men. In women, the associations were less pronounced. Although being motorized for a longer period showed a tendency toward more weight gain (p=0.008) but not WC gain (p=0.76), education and income were more strongly related to weight (WC) change. In particular, high education was protective against waist gain in women.

Because the possession of motorized vehicles could be a proxy of SES or urbanicity, the association between motorized transportation and obesity may vary with region and income. Motorized transportation had an impact on weight gain in men living in rural regions (p=0.019), but not in urban regions (p=0.38; Figure 1). However, no effect modification by living region was found between region and motorized transportation for weight (p=0.29 for interaction) and waist gain (p=0.78 for interaction) from the likelihood ratio test. Motorized transportation had an impact on weight (p=0.054) and WC gain (p=0.006) in men having high income, but not low income (Figure 2). No effect modification by income was found between income and motorized transportation for weight (p=0.15 for interaction) or waist gain (p=0.11 for interaction).

The association of motorized transportation with the current obesity status at 2006 is presented in Table 3. The OR of obesity was 1.30 (95% CI=0.97, 1.74) and 1.93 (1.50, 2.49) for the motorized transportation >5 years group in men and women. The association of SES and region with the current obesity status was presented in Appendix B (available online at www.ajpmonline.org). Income (p=0.03 for interaction) and education (p=0.06 for interaction) tended to modify the association between motorized transportation and current BMI in women, with the impact of motorized transportation being stronger in women having low income or education (data not shown).

As an additional sensitivity test to assess whether the results were influenced by the missing values, 26.5% of 5240 participants with missing values were imputed and performed all analyses in the ten complete data sets separately, and results were pooled into single estimated beta coefficients. Compared with the presented results, the imputed results did not change appreciably and did not influence the conclusions (data not shown).

Table 2. The changes in body weight and waist circumference in men and women, 1997–2006 (n=3853)

Factors	Men: Weight change (kg)	Men: WC change (cm)	Women: Weight change (kg)	Women: WC change (cm)
Transportation				
Nonmotorized	1.3 (0.5)	2.6 (0.5)	1.5 (0.4)	2.8 (0.5)
Motorized 1–5 years	2.1 (0.6)*	3.0 (0.6)	2.2 (0.6)*	3.1 (0.6)
Motorized >5 years	2.5 (0.7)**	3.6 (0.7)**	2.4 (0.6)*	2.9 (0.6)
p for trend	0.006	0.017	0.008	0.76
Education				
Low	1.3 (0.7)	2.7 (0.6)	1.9 (0.4)	3.7 (0.5)
Low middle	1.6 (0.5)	2.9 (0.5)	2.3 (0.5)	2.4 (0.6)*
Upper middle	2.6 (0.8)*	3.3 (0.7)	1.3 (0.8)	1.6 (0.8)**
High	4.1 (1.7)**	3.4 (1.6)	0.9 (2.0)	−0.5 (2.1)***
p for trend	0.002	0.25	0.36	<0.001
Income				
Low	1.4 (0.7)	2.9 (0.7)	1.3 (0.6)	2.7 (0.6)
Low middle	1.3 (0.7)	2.7 (0.7)	1.7 (0.6)	3.1(0.6)
Upper middle	2.1 (0.7)	2.9 (0.7)	2.0 (0.6)	2.6 (0.6)
High	2.6 (0.7)*	3.3 (0.7)	2.7 (0.6)**	3.2 (0.8)
p for trend	0.012	0.43	0.003	0.63
Region				
Urban	1.9 (0.6)	2.7 (0.6)	1.8 (0.6)	2.7 (0.6)
Rural	1.9 (0.4)	3.1 (0.4)	2.0 (0.4)	3.0 (0.4)
p for trend	0.97	0.27	0.58	0.46
Occupational physical activity				
Light	2.4 (0.6)	3.9 (0.6)	2.2 (0.5)	3.1 (0.6)
Middle	1.7 (0.6)	3.0 (0.6)*	1.7 (0.5)	2.8 (0.5)
Heavy	1.5 (0.6)*	2.0 (0.6)***	1.9 (0.5)	2.8 (0.5)
p for trend	0.052	<0.001	0.54	0.49

Model adjusted for baseline weight, height, age and waist change, follow-up time, and total energy and fat intake. For men, model additionally adjusted for smoking and alcohol drinking. Depending on the dependent variable, model was also adjusted for motorized transportation, education, income, living region, and occupational physical activity.
$*p<0.05$, $**p<0.01$, $***p<0.001$.
WC, waist circumference

Discussion

A longer period of having motorized transportation was independently related to a larger gain in weight and WC in Chinese men after 7.8 years' follow-up, when compared with those who never owned motorized vehicles. The gain in weight and WC was slightly more pronounced in men with a higher income or from rural areas, but the difference compared with low income or urban areas was not significant. In women, using motorized transportation was only related to weight gain and not WC gain, but the tendency was less pronounced than in men. A longer period of having motorized transportation in the past was also independently associated with a higher OR of current adiposity in men and women.

The present study can be compared with a previous study by Bell et al.[24] They suggested that the possession of

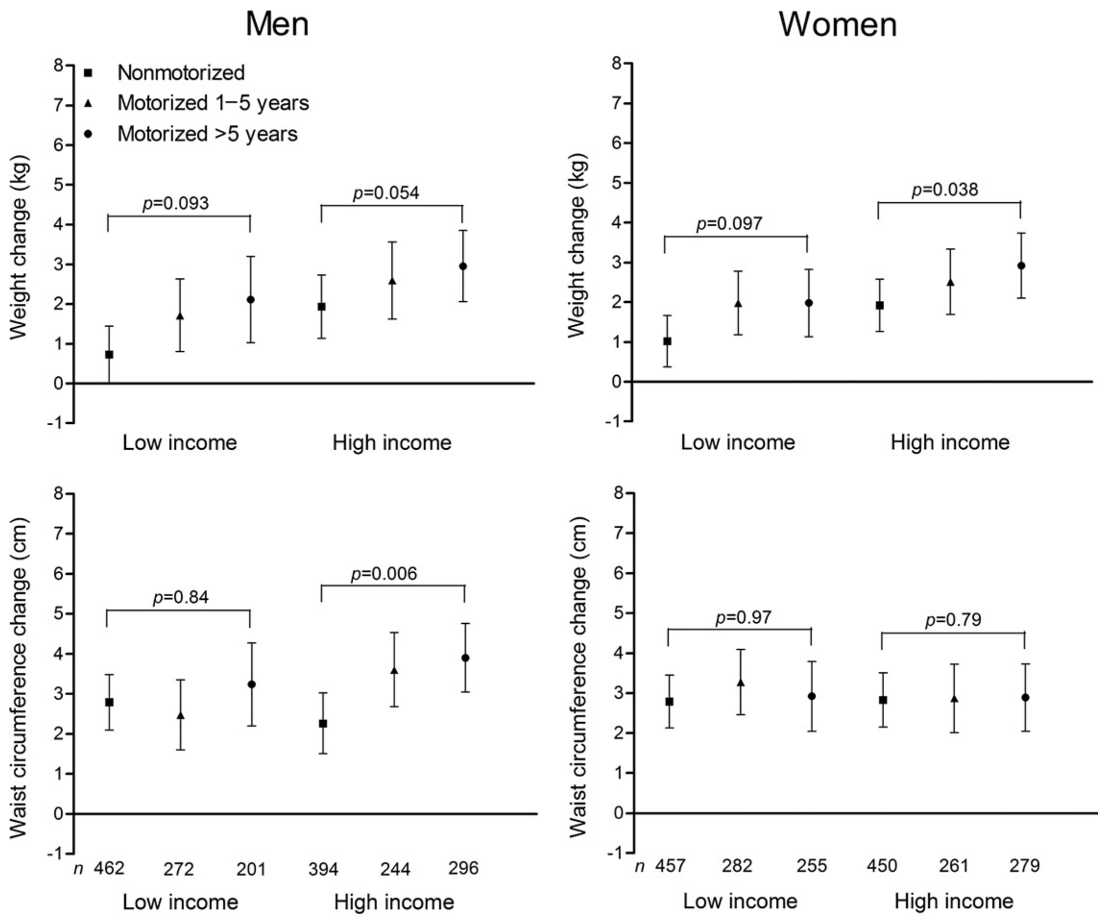

Figure 2. Changes in body weight and WCs according to duration of motorized transportation, stratified for gender and income

Note: Results are adjusted for baseline weight, height, age and WC (for change in WC), follow-up time, total energy and fat intake, occupational physical activity, education, and living region. For men, additional adjustments were made for smoking and alcohol consumption.

WC, waist circumference

motorized vehicles was associated with an increase in obesity and weight gain in Chinese men, based on CHNS data from 1989 to 1997. However, few people acquired motorized vehicles between 1989 and 1993, and less than 13% of the participants had motorized vehicles before 1997.[24] Because of the possible time lag between the dependence on motorized vehicles and the onset of obesity, the authors at that time might not have been able to fully conclude that motorized transportation independently contributed to an increased obesity rate.

The present analysis covers a rapidly changing period from 1997 until 2006, and the duration of using motorized transportation may give better prospective information than vehicle ownership defined as a dichotomous variable. Another difference is that WC was additionally measured at the onset of the present study, and it appears to be very important in assessing obesity-related metabolic risks in the Chinese population.[25] It was found that Chinese men (motorized transportation for >5 years) had independently gained more weight and WC than those who never possessed vehicles during the follow-up and were more likely to be (abdominally) obese in 2006. Such an association suggests that having used motorized transportation for a longer period contributes to obesity.

These associations were adjusted for income and education, and motorized transportation as a proxy for socioeconomic wealth had only marginal effects on the strength of the association. However, the adjustments were not equal to controlling for wealth, and some degree of residual confounding cannot be excluded. With regard to women, the association between motorized transportation and weight gain was less pronounced, and it is difficult to draw a firm conclusion. A possible explanation is that men were more likely to be the predominant users of motorized vehicles in Chinese households.[24]

The potential influence of regional differences was investigated, assuming that urban residents may be the first to experience changes, leading to “modernized” lifestyles, the early access to motorized transportation, and a high obesity rate. In the present study, rural residents tended

Table 3. The association between motorized transportation and current adiposity in men and women, 2006 (n=3853)

	Men				Women			
Transportation	Mean BMI	Obesity OR (95% CI)	Mean WC (cm)	Abdominal obesity OR (95% CI)	Mean BMI	Obesity OR (95% CI)	Mean WC (cm)	Abdominal obesity OR (95% CI)
Nonmotorized	22.96 (0.28)	ref	80.9 (0.7)	ref	22.97 (0.24)	ref	79.2 (0.6)	ref
Motorized 1–5 years	23.37 (0.35)	1.35 (1.02, 1.79)	81.5 (0.9)	1.34 (0.97, 1.87)	23.74 (0.31)***	1.68 (1.32, 2.15)	78.5 (0.9)	0.90 (0.69, 1.18)
Motorized >5 years	23.28 (0.37)	1.30 (0.97, 1.74)	81.8 (0.9)	1.38 (0.99, 1.94)	23.73 (0.32)***	1.93 (1.50, 2.49)	78.2 (0.8)	0.89 (0.67, 1.17)
p for trend	0.13	0.054	0.13	0.047	<0.001	<0.001	0.058	0.37

Note: BMI, WC, and adiposity were measured at the end of follow-up. Model adjusted for baseline age, follow-up time, total energy and fat intake, and current BMI (for WC and abdominal obesity). For men, model additionally adjusted for smoking and alcohol drinking. Depending on the dependent variable, model was also adjusted for motorization, income, education, living region, and occupational physical activity.
*$p<0.05$, **$p<0.01$, ***$p<0.001$.
WC, waist circumference

to gain somewhat more weight and WC than urban residents, but the differences were not pronounced. Further, living in rural regions had a slightly stronger impact on the association between motorized transportation and weight change, although the findings do not support the significant modification of this association by living region.

One of the possible explanations is that the regional variation was diminished by continuous development in some rural regions. Therefore, rural residents also might have experienced increased income and use of motorized transportation and a larger increase in obesity than urban residents in the past decades.[2,26–28] However, misclassification of the urban–rural dichotomous variable, which might not reflect the full variation in health given the heterogeneity emerging in these areas because of the degree of urbanicity,[27] cannot be completely ruled out.

Social inequality in adiposity differs between men and women, which may be explained by the current stage of development. A high SES, as proxied by high income and education, was positively associated with adiposity in men. However, high education was inversely and strongly associated with adiposity in women, which is in line with previous findings in women from rapidly developing countries.[28–32] Income effects were absent in women. This pattern was consistent with findings from Brazilian women, especially with those from more economically developed parts.[31] Further, use of motorized transportation tended to be associated more positively with only current BMI in women with low SES in the present study. In the early stage of economic development, as the level of urbanization increases, the burden of obesity might shift from those with high SES toward those with low SES first among women from developing countries.[26,32,33] It is important to realize that social inequality in adiposity is in transition because of the levels of development and urbanization.[28,30]

Strengths and Limitations

The major strengths of the current study include the use of prospective CHNS data from 1997 until 2006, covering a time frame in China during which large changes occurred. It has provided insight into the association between use of motorized transportation and SES with adiposity. The present study also has potential limitations. The period during which motorized transportation was used might have been misclassified because of the household possession of motorized vehicles, and the true impact of motorized transportation use on adiposity was likely attenuated.

A well-informed prospective study is needed to further investigate the extent to which reduced energy expenditure due to motorized transportation contributes to changes in body composition. Although the present results suggest a relationship between motorized transportation use and larger weight/waist circumference gain, the results do not show causality. For instance, people may choose transportation patterns because of other unmeasured factors, such as socioeconomic wealth or the accessibility to modern infrastructure. Third, domestic physical activity was not assessed, which was presumably important for daily energy expenditure in Chinese women, although a recent study performed in the same population did not find that reduced domestic physical activity resulted in higher body weight in women.[16] Finally, it has been found that changes in dietary patterns were strongly associated with adiposity in the Chinese population.[26,34] Although dietary intake was adjusted for the present models, residual confounding cannot be excluded.

Conclusion

Motorized transportation was related to the increase in adiposity in this Chinese population in an average 7.8-year follow-up, particularly for men. It did not vary considerably with income or living region. For women, education was a more important determinant for weight gain than motorized transportation. However, the continuous socioeconomic transition may alter and differentiate the social inequality in adiposity of men and women, and influence the types of physical activity participation in China.[4,17,35] Assuming that the sustained development affects all Chinese inhabitants, a small increase in active transportation may have the potential to prevent obesity in this population.[4,36,37] An active lifestyle should be promoted for all, combined by increased active transportation patterns and leisure-time physical activity, to achieve the best health benefits.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.amepre.2012.03.022.